



A case-study based analysis of the specific characteristics of a compound rain-storm / flash-flood / debris flow event: Influences of hydro-geo-environmental conditions and anthropogenic impacts

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Flash-Floods are triggered by high-intense rainfall, propagated by wide-spread infiltration excess overland flow and fast runoff concentration, yielding extreme discharge rates and inundation. Furthermore, the extreme discharge may cause severe erosion processes, both in the catchment and the channel network, which again might trigger landslides and the mobilization and further transport of scree, muddy and woody debris. In case vulnerable areas, such as settlements, are affected by such events, there is a high risk for damage and danger for health and life of the population. Thus, such incidents are typical compound events, which have to be analyzed by a cascading and interdisciplinary approach.

We have followed such an approach conducting a detailed forensic case study analysis. We have taken the flash-flood in Braunsbach in SW-Germany as an example, where a particularly concise flash flood event occurred at the end of May 2016. This extreme compound event led to an immense damage in this particular village. The event has been retrospectively analyzed with regard to meteorology, hydrology, geomorphology and damage to obtain a quantitative assessment of the processes and their development.

The results show that it was a very rare rainfall event with extreme intensities, which in combination with catchment properties and altered environmental conditions led to extreme runoff, extreme debris flow and immense damages. Due to the complexity of the interacting processes, no single flood cause can be identified, since only the interplay of those lead to such an event. We have shown that environmental changes (climate change, agricultural land-use, river and geomorphological engineering) are important, but – at least for this case study – even natural weather and hydrologic conditions would have resulted in an extreme flash flood event, too.